

NON-PUBLIC?: N  
ACCESSION #: 9310200290  
LICENSEE EVENT REPORT (LER)

FACILITY NAME: St. Lucie Unit 1 PAGE: 1 OF 4

DOCKET NUMBER: 05000335

TITLE: Three manual reactor trips to prevent equipment damage by Jellyfish influx.  
EVENT DATE: 09/18/93 LER #: 93-007-0 REPORT DATE: 10/14/93

OTHER FACILITIES INVOLVED: St. Lucie Unit 2 DOCKET NO: 05000389

OPERATING MODE: 1 POWER LEVEL: 75

THIS REPORT IS SUBMITTED PURSUANT TO  
THE REQUIREMENTS OF 10 CFR SECTION:  
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:  
NAME: Michael J. Snyder, TELEPHONE: (407) 465-3550  
Shift Technical Advisor  
COMPONENT FAILURE DESCRIPTION:  
CAUSE: N/A SYSTEM: COMPONENT: MANUFACTURER:  
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: No

#### ABSTRACT:

On September 18, 20, and 22, 1993, while Unit 1 was at 100%, 63%, and 60% power respectively, a large number of jellyfish were drawn from the Atlantic Ocean into the intake canal. This condition created a large differential pressure across the intake traveling screens necessitating the removal of non-safety related circulating water pumps from service. In accordance with Off-Normal Operating Procedure 1-0620030, Circulating Water System, manual reactor and turbine trips were initiated on Unit 1 at power levels of 75%, 63%, and 11% respectively as cooling water to one of the main turbine condensers was removed from service. In each case the Standard Post Trip Actions of EOP-1 led to a diagnosis of an uncomplicated reactor trip. EOP-1 was exited and upon completing EOP-2, Reactor Trip Recovery, the Unit was stabilized in Mode 3, Hot Standby. During this time period, the safety related intake cooling water system remained in service.

The root cause of the event was that an abnormal influx of jellyfish was greater than the intake traveling screen system could efficiently handle.

Interim corrective actions for this event were: The unit was maintained at reduced power or kept offline at appropriate times to prevent equipment damage. The intake traveling screens were manned and operated as necessary with the Circulating Water Pump discharge valves throttled to minimize the jellyfish influx at the intake structure. The influx of jellyfish subsided on 29 September.

END OF ABSTRACT

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#### DESCRIPTION OF THE EVENT

On September 18, 1993, while Unit 1 was at 100 percent power, a large number of jellyfish were observed in the intake canal. Operations personnel then performed steps to alleviate the fouling of the intake structure, which supplies cooling water to the Intake Cooling Water system (EIS:KE) and the Circulating Water System (EIS:SG). The intake traveling screens were run continuously with manual operation of the intake rakes in an attempt to maintain nominal traveling screen differential pressure and circulating water flow. At approximately 0500, the 1B1 intake traveling screen stopped due to its shear pin functioning to prevent equipment damage caused by an excessive load condition. Operators downpowered Unit 1 and throttled the 1B1 Circulating Water Pump (CWP) discharge valve to 30 percent open. When unit power was stabilized at 75 percent operators secured the 1B1 CWP in accordance with Off-Normal Operating Procedure 1-0620030 Circulating Water System. At 0525, another large incursion of jellyfish caused increasing traveling screen differential pressures on the 1A2 and 1B2 intake wells. The 1B2 traveling screen automatically stopped due to a motor thermal overload relay trip which functioned as designed due to heavy screen load. With the pending loss of all CWPs to the B main turbine condenser (EIS:SG), operators initiated a manual reactor and turbine trip in accordance with OP 1-0620030. The Standard Post Trip Actions of EOP-1 were completed with a diagnosis of an uncomplicated reactor trip. Operators exited EOP-1 and completed EOP-2 Reactor Trip Recovery to stabilize the plant in Mode 3, Hot Standby. After restoration of the affected intake traveling screens, Unit 1 was restarted with administrative limitations on September 19 when the jellyfish influx slowed.

On September 20, 1993, while Unit 1 was at 63 percent power, the

intake traveling screens were being run continuously with manual operation of the intake rake. The 1A1 intake traveling screen and 1A1 CWP were manually secured due to a high screen differential pressure. At 1205, the 1A2 traveling screen stopped by a shear pin functioning to prevent equipment damage. At 1208, with the pending loss of all CWPs to the A main turbine condenser, operators initiated a manual reactor and turbine trip in accordance with OP 1-0620030. The 1A2 CWP was then secured. The Standard Post Trip Actions of EOP-1 were completed with a diagnosis of an uncomplicated reactor trip. Operators exited EOP-1 and completed EOP-2 Reactor Trip Recovery to stabilize the plant in Mode 3, Hot Standby. After restoration of the affected intake traveling screens and implementation of additional countermeasures to minimize the jellyfish influx, Unit 1 was restarted on 21 September, 1993.

On September 22, 1993, while Unit 1 was at 60 percent power, the intake traveling screens were being run continuously with manual operation of the intake rake. At approximately 0030, the 1A1 and 1B1 intake traveling screen high differential pressure conditions prompted operators to downpower Unit 1 to 32 percent and secure the 1A1 and 1B1 CWPS. At 0100, Operations was able to restore the 1A1 traveling screen and restart the 1A1 CWP. At 0215, another large incursion of jellyfish caused increasing traveling screen differential pressure on the 1B2 intake well. With the pending loss of all CWPs to the B main turbine condenser, operators downpowered the unit to 11 percent and then initiated a manual reactor and turbine trip. The Standard Post Trip Actions of EOP-1 were completed with a diagnosis of an uncomplicated reactor trip. Operators exited EOP-1 and completed EOP-2 Reactor Trip Recovery to stabilize the plant in Mode 3, Hot Standby. Unit 1 was maintained in Hot Standby until 24 September, when the worst of the jellyfish influx had passed.

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## CAUSE OF THE EVENT

Cooling water for the St. Lucie plant is supplied by the Atlantic Ocean via an offshore intake and pipeline to a canal that runs to the intake structures on the west side of the plant. The ocean intake structures are located 1200 feet offshore and are approximately 8 feet below the surface at low tide. A velocity cap covers each ocean intake structure and is designed to provide a flow rate in a horizontal direction so that fish entrapment is minimized. However, since jellyfish are passive drifters, the velocity cap will not prevent them from becoming entrained at the ocean intake.

The jellyfish (species Aurelia Aurita) became susceptible to entrainment in the seasonal movement of the Gulf Stream closer to the shoreline. These jellyfish can reach 18 inches in diameter and can weigh several pounds. The influx density reached several jellyfish per square meter of water surface. The influx subsided on 29 September when the wind direction changed.

There are four non-safety related traveling screens each with an associated CWP located at the end of the intake canal where the cooling water enters each unit. The screens are intended to prevent organisms and debris from passing into the plant. The screens will automatically wash down when the differential pressure across the screen reaches a setpoint of 6 inches of water. At 10 inches the traveling screens shift to a faster rate of travel. A shear pin will function to prevent equipment damage when the screens are overloaded with debris. Additionally, the traveling screen motors are protected by thermal overload relays. When a traveling screen is secured due to a high differential pressure across the screen its associated CWP is secured to prevent damage to the screen cavitation of the pump. Securing both CWPs feeding a main condenser require that the main turbine be taken offline to prevent exceeding a Low Pressure Turbine operational limit of 2.5 inches Hg differential pressure between the two condensers.

Each of the three manual reactor and turbine trips were to prevent equipment damage due to jellyfish clogging of the intake traveling screens. The root cause of these events was that an abnormal influx of jellyfish was greater than the intake traveling screen system could efficiently handle.

## ANALYSIS OF EVENT

These events are reportable under the requirements of 10CFR50.73.a.2.iv as events that resulted in a manual actuation of the Reactor Protective System.

The plant response during these reactor trips was observed to be normal. All safety related systems functioned as designed. The event was bounded by the analysis described in Section 15.2.7.2.3 of the St. Lucie Unit 1 FUSAR, "Loss of Condenser Vacuum." The actual plant response was much more conservative than that described in the analysis for several reasons: 1) The reactor and turbine trips were manually initiated prior to reaching any automatic setpoints. 2) The plant was not at full power when the events occurred. 3) A complete loss of condenser cooling did not occur, so the Steam

Bypass Control System was available to remove heat from the Steam Generators. 4) Steam Generator water levels remained above the Auxiliary Feedwater Actuation Setpoint.

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#### ANALYSIS OF EVENT (continued)

Cooling water from the Atlantic services two systems: the non-safety related Circulating Water System (CWS) and the safety related Intake Cooling Water System (ICW). The two independent trains of the ICW system supply cooling water to the component cooling water heat exchangers, open blowdown heat exchangers, and the turbine cooling water heat exchangers. The CWS removes heat rejected to the two condensers from the main turbine. This is accomplished by four CWPS, each with a nominal flowrate of 140,000 gpm. A failed traveling screen requires the shutdown of its associated CWP to avoid damage to the screen by excessive differential pressure across the screen or cavitation of the pump. The three safety related ICW pumps share 1A1, 1A2 and 1B1 intake wells with the CWS. The ICW pumps are not required to be secured upon the removal of a traveling screen from service because they have a nominal flowrate of only 14,000 gpm and will not dewater an intake well as the CWS pumps are capable of doing. Additionally, the ICW system contains strainers to minimize fouling of heat exchangers. During the influx of jellyfish, these strainers were cleaned on a more frequent basis.

Unit 2 utilizes the same intake canal, but it did not experience as many jellyfish because the prevailing winds and water currents tended to push the jellyfish to the Unit 1 intake structure.

The health and safety of the public was not affected by these events.

#### CORRECTIVE ACTIONS

1. Operations stationed personnel as necessary at the intake structures of Unit 1 and Unit 2 to continuously run the intake traveling screen and to operate the trash rake during unit operations with jellyfish present.
2. Operations maintained Unit 1 and Unit 2 in a reduced power condition as necessary to throttle circulating water flow and minimize the influx of jellyfish.

3. Operations monitored the ICW systems for proper operation.
4. A temporary air bubbler and surface net were placed in the intake to collect and facilitate the removal of jellyfish.
5. Mechanical Maintenance increased the frequency of preventative maintenance on the traveling screens during this period of increased usage.

#### ADDITIONAL INFORMATION

Failed Component Identification: None.

Previous Similar Events : The most recent previous similar event was LER 335-84-09 "Manual Reactor Trip/Intake Screen Fouling."

ATTACHMENT 1 TO 9310200290 PAGE 1 OF 1

P.O. Box 128, Ft. Pierce, FL 34954-0128

FPL October 14, 1993

L-93-266  
10 CFR 50.73

U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D. C. 20555

Re: St. Lucie Unit 1  
Docket No. 50-335  
Reportable Event: 93-007  
Date of Event: September 18, 1993  
Three manual reactor trips to prevent  
equipment damage by Jellyfish influx

The attached Licensee Event Report is being submitted pursuant to the requirements of 10 CFR 50.73 to provide notification of the subject event.

Very truly yours,

D. A. Sager  
Vice President  
St. Lucie Plant

DAS/JWH/kw

Attachment

cc: Stewart D. Ebnetter, Regional Administrator, USNRC Region II  
Senior Resident Inspector, USNRC, St. Lucie Plant

DAS/PSL #1007-93

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